COMPARATIVE ULTRAMORPHOLOGY OF THE PROVENTRICULUS BULB OF TWO SPECIES OF MUTILLIDAE (HYMENOPTERA)

Flávio Henrique Caetano [1, 3]
Xavier Espadaler [2]
Fernando José Zara [1]

ABSTRACT

The proventriculus bulb of two species of Mutillidae wasp, *Mutilla ghillianii* Spin. and *Myrmilla capitata* Lucas are studied. The cuticular projections on the mobile lips in *Mutilla ghillianii* are longer than in *Myrmilla capitata*.

KEYWORDS. Ultramorphology, Proventriculus, Mutillidae, Hymenoptera.

INTRODUCTION

The proventriculus of insects is usually considered to be a region connecting the crop to the stomach. This region may be more or less elaborate according to the feeding habits of the insect, presenting structures that may aid both the separation of food and its maceration for later digestion (Chapman, 1975). These auxiliary structures (hairs or cuticular teeth) are restricted to a region denoted proventriculus bulb which invariably projects into the crop. These structures in bees helps the separation of nectar to be converted in honey from the pollen grains to be digested (Snodgrass,1935, 1956). In ants, the proventiculus bulb acts as a barrier to the food to be stored in the crop for short or long periods. The proventriculus bulb of ants has also been used as an element for phylogeny by Eisner (1957) and Tomotake (1997). In social wasps the bulb consists of four mobile lips with a strong cuticular structure on the apex of which there are structures like a threads (Caetano & Machado, 1982; Caetano & Overal, 1984). Its function as filtering elements, as is the case of other Hymenoptera. In *Polistes versicolor* (Olivier, 1791) and *Polybia paulista* (Ihering, 1896) the structures present in the lips are robust and seem to be related to the process of food maceration rather than filtration, as propose for other Hymenoptera (Zuben & Caetano, 1994).

1. Dpto. de Biologia UNESP, Campus de Rio Claro, CEP 13506-900 SP, Brasil.
2. Centre de Recerca Ecologica I Aplicacions Forestals, Edifici C., Universitat Autonoma de Barcelona, 08193, Bellaterra, Spain.
3. CNPq (Processo: 401538/90-7)

The aim is to show the variations in the proventriculus bulb in two species of solitary wasps of the family Mutillidae.

MATERIAL AND METHODS

Five specimens of *Mutilla ghillianii Spin.* and nine of *Myrmilla capitata* Lucas were collected on the campus of the Universitat Autònoma de Barcelona, Bellaterra, Spain, where some specimens are deposited.

The insects were anesthetized with ether vapor, dissected in physiological saline, fixed in aqueous Bouin's fluid for 12 hours and then transferred to 70% alcohol. After fixation, the crop region was dissected to expose the proventriculus bulb, which was then dehydrated in increasing butyric alcohol concentrations (up to 100%) for 10 minutes and then submitted to two baths in 100% acetone, each of 10 minutes duration. The material was brought to the critical point, mounted an 3M metal tape and covered with gold in a Balzer sputtering. The mounted material was examined with a Hitachi 570 SEM at 25 Kv and photographs were taken with Ilford-HP5-ISO 400/270 film.

RESULTS AND DISCUSSION

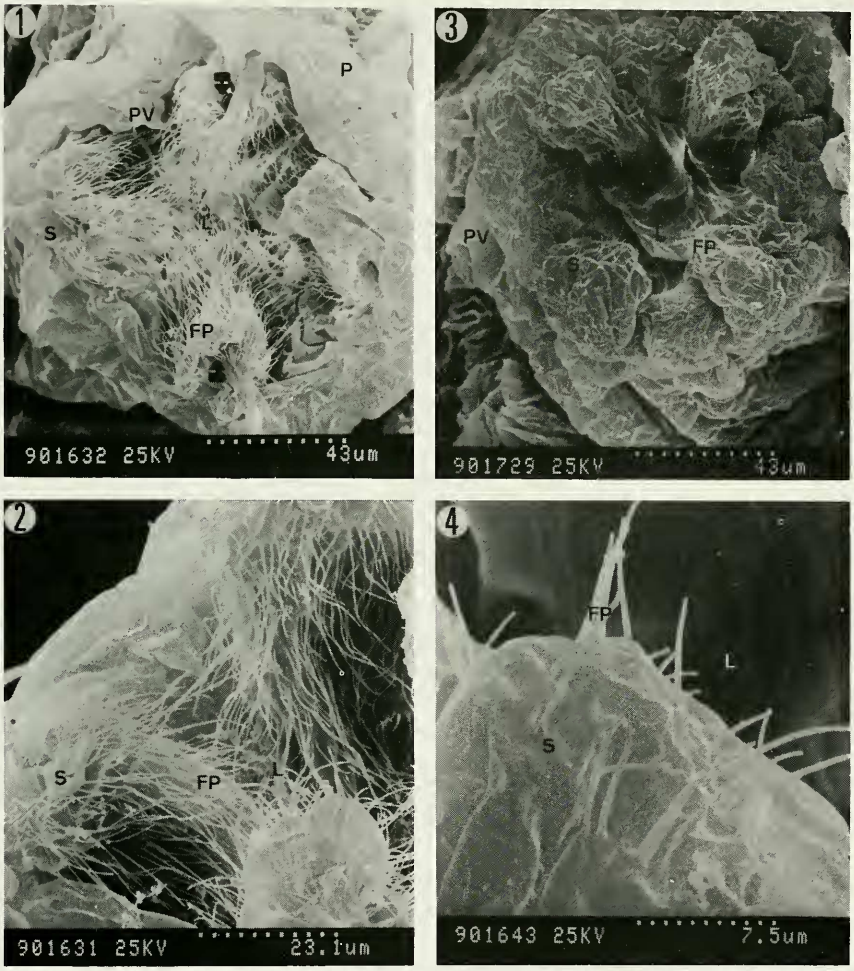
The proventriculus of *Mutilla ghillianii* and *Myrmilla capitata* (figs 1 - 4) shows differences in the two genera, with *M. ghillianii* (figs. 1, 2) showing much larger amounts of cuticular projections than *M. capitata.* In *Myrmilla capitata* (figs. 3, 4) the cuticular projections are quite reduced both in terms of size and number, and may even be considered absent. Note how the surface of the mobile lip is smooth below the cuticular projections. This species has no orifice on the outer surface of the mobile lip immediately below the point where the cuticular projections start, which is responsible for the facilitation of the mobility of the organ.

The proventriculus bulb of *Mutilla ghillianii* (figs. 1, 2) is similar to that found in ants, of the genus *Myrmecia,* which are thought to belong to the least derived subfamily of Formicidae (CAETANO, observed data). As is the case of *Myrmecia,* each mobile lip presents countless cuticular projections on the apex and on the surface that fills the lumen of the proventriculus. On the outer surface of each mobile lip there is an orifice immediately below the site where the cuticular projections start (fig. 1, arrow). In *Myrmecia* ants and in *Polybia paulista* and *Polistes versicolor* social wasps this orifice has been associated with facilitation of the mobility of the mobile lip. This mobility takes place by action of the longitudinal muscles present in this region (ZUBEN & CAETANO, 1994).

The presence of longitudinal muscles attached to the mobile lip was described by EISNER (1957) for ants. There are three longitudinal muscle bundles (inner, median and outer) in the proventriculus neck of *Neoponera villosa* (Fabricius, 1804), but did not propose its association with the mobile lips movement (CAETANO, observed data).

In *Mutilla ghillianii* the cuticular projections measure on average 16.2 μm and in *M. capitata* 6.6 μm. These data show that in *Myrmilla capitata* the cuticular projections do not function as a filter.

The reduced number and length of the cuticular projections on the proventriculus bulb of *Myrmilla capitata* compared to *Mutilla ghillianii* suggests the gradual loss of these structures. This fact has also been noted in ants of the subfamily Ponerinae (TOMOTAKE, 1997). The reduction in size and number of cuticular projections may be involved in the



Figs. 1 - 4. *Mutilla ghillianii*: 1, proventriculus. The arrow indicates the orifice immediately below the point where the projections start which is responsible for lip flexibility; 2, Detail of the filiform projections fully penetrate the lumen, covering large part of mobile lip. *Myrmilla capitata*: 3, proventriculus; 4, Detail of the apex of a mobile lip from the previous figure showing the filiform cuticular projections. (FP, filiform cuticular projections; L, lumen; P, reverse crop epithelium; PV, proventriculus; S, mobile lips).

possible alterations of the feeding habits of these insects along the derivative process.

REFERENCES

CAETANO, F. H. & MACHADO, V. L. L. 1982. Morfologia e histologia do trato digestivo de *Protopolybia exigua exigua* (Hymenoptera, Vespidae) e suas estruturas excretoras anexas. **Papéis Avuls. Zool.**, São Paulo **34**: 283-296.

CAETANO, F. H. & OVERAL, W. L. 1984. Estudos do trato digestivo de vespas (Hymenoptera:Vespidae) e estruturas excretoras associadas. I. Morfologia. **Revta bras. Ent.**, São Paulo, **28** (4): 403-408.

CHAPMAN, R. F. 1975. **The insects, structure and function**. New York, American Elsevier. 819p.

EISNER, T. A. 1957. A comparative morphological study of the proventriculus of ants (Hymenoptera; Formicidae). **Bull. Mus. comp. Zool. Harv.**, Boston, **116**: 438-490.

SNODGRASS, R. E. 1935. **Principles of Insects Morphology.** New York, Comstock. 667p.

__. 1956. **Anatomy of honey bee**. New York, Comstock. 334p.

TOMOTAKE, M. E. M. 1997. **Ultra-estrutura do proventrículo de operárias da subfamília Ponerinae (Hymenoptera: Formicidae)**. 129p. Tese (Doutorado em Zoologia). Instituto de Biociências - UNESP, Rio Claro. [Não publicado].

ZUBEN, C. J. VON & CAETANO, F. H. 1994. Ultramorfologia do proventrículo de *Polybia paulista* (Ihering, 1896) e *Polistes versicolor* (Olivier, 1791) (Hymenoptera: Vespidae). **Naturalia**, São Paulo, **19**: 45-54.

Recebido em 06.04.1998; aceito em 23.07.1998.